

Amendments to the Claims:

This listing of claims will replace all prior versions and listings of claims in the application.

Listing of Claims:

Claim 1 (currently amended): An apparatus for processing a semiconductor wafer, comprising:

- a. an upper element;
- b. a lower element, wherein the upper element and the lower element are configured to be brought together to form a processing volume; [[and]]
- c. a seal energizer that comprises a seal-energizing cavity coupled to the upper element and configured to maintain the upper element against the lower element by a sealing pressure generated within the seal-energizing cavity to maintain the processing volume by maintaining a difference between a sealing force and a force generated within the processing volume within a range selected from a plurality of ranges, the force generated within the processing volume produced by a processing pressure that varies between a vacuum and a supercritical pressure; and
- d. a pressure controller configured to automatically non-linearly vary the sealing pressure to lag a processing pressure generated within the processing volume and maintain the processing volume during processing.

Claim 2 (currently amended): The apparatus of claim 1, wherein the seal energizer is configured to ~~minimize~~ apply a non-negative net force against one of the upper element and the lower element above a threshold value, the net force following the equation $P1 \cdot A1 - P2 \cdot A2$ $P2 \cdot A2 - P1 \cdot A1$, wherein [[P1]] P2 equals the sealing pressure, [[P2]] P1 equals a pressure generated within the processing volume, [[A1]] A2 equals a cross-sectional area of the seal-energizing cavity, and [[A2]] A1 equals a cross-sectional area of the processing volume.

Claim 3 (canceled)

Claim 4 (currently amended): The apparatus of claim 1, wherein the seal energizer further comprises a first cavity ~~and a seal-energizing cavity~~, wherein the first cavity is coupled to the seal-energizing cavity, and the seal energizer is configured so that a first pressure generated within the first cavity generates a second pressure in the seal-energizing cavity larger than the first pressure.

Claim 5 (currently amended): The apparatus of claim 2, wherein the cross-sectional area $[[A1]]$ A2 is larger than the cross-sectional area $[[A2]]$ A1.

Claim 6 (original): The apparatus of claim 1, further comprising a means for generating supercritical conditions coupled to the processing volume.

Claim 7 (original): The apparatus of claim 6, further comprising a CO₂ supply vessel coupled to the processing volume.

Claim 8 (original): The apparatus of claim 1, wherein the upper element and the lower element form a supercritical processing chamber.

Claim 9 (original): The apparatus of claim 1, wherein the seal energizer comprises a hydraulic piston coupled to the lower element and configured to maintain the processing volume.

Claim 10 (currently amended): An apparatus for processing a semiconductor wafer, comprising:

- a. an upper element;
- b. a lower element coupled to a seal-energizing cavity, wherein the upper element and the lower element are configured to be brought together to form a processing volume; and
- c. means for automatically non-linearly varying a sealing pressure within the seal-energizing cavity to maintain within a selected preselected range a difference between a sealing force and a force generated within the processing volume, thereby maintaining the processing volume, ~~wherein the force generated within the processing volume is produced by a processing pressure that varies between a vacuum and a supercritical pressure.~~

Claim 11 (withdrawn): A method of maintaining a processing volume, the method comprising the steps of:

- a. generating a processing pressure within a processing volume; and
- b. controlling a sealing pressure to form and maintain a processing volume, wherein during a processing cycle the sealing pressure is varied non-linearly with the processing pressure.

Claim 12 (withdrawn--currently amended): The method of claim 11, wherein the sealing pressure is related to the processing pressure by the equation $\Delta F = P1 \cdot A1 - P2 \cdot A2$ $P2 \cdot A2 - P1 \cdot A1$, wherein [[P1]] P2 equals the sealing pressure, [[P2]] P1 equals the processing pressure, [[A1]] A2 equals a cross-sectional area of a seal-energizing cavity, and [[A2]] A1 equals a cross-sectional area of a processing volume, and the sealing pressure is varied to maintain ΔF above a threshold value.

Claim 13 (withdrawn): The method of claim 12, wherein a cross-sectional area of the processing volume is smaller than a cross-sectional area of the seal-energizing cavity.

Claim 14 (withdrawn): The method of claim 11, wherein the step of generating a processing pressure comprises containing a high-pressure processing fluid in the processing volume.

Claim 15 (withdrawn): The method of claim 14, wherein the high-pressure processing fluid comprises supercritical carbon dioxide.

Claim 16 (withdrawn): The method of claim 12, wherein the step of controlling a sealing pressure comprises generating a hydraulic pressure in the seal-energizing cavity.

Claim 17 (canceled)

Claim 18 (currently amended): The apparatus of claim 1, wherein the ~~seal energizer comprises a~~ pressure controller is programmed to maintain a difference between a sealing force and a force generated within the processing volume within a preselected ~~for determining a sealing pressure from a pressure generated within the processing volume and the selected range.~~

Claim 19 (currently amended): The apparatus of claim ~~[[1]]~~ 18, wherein a lower bound of the ~~selected~~ preselected range includes a minimum force for maintaining the processing volume.

Claim 20 (previously presented): The apparatus of claim 19, wherein the minimum force is based on a delay between generating the sealing force and generating the force within the processing volume.

Claim 21 (previously presented): The apparatus of claim 1, wherein the force generated within the processing volume varies during a processing cycle.

Claim 22 (currently amended): An apparatus for processing a semiconductor wafer, comprising:

- a. a processing chamber comprising a processing volume for processing the semiconductor wafer by generating a ~~variable~~ processing pressure; and
- b. means for maintaining the processing volume by ~~determining~~ sensing the ~~variable~~ processing pressure during processing and automatically generating a sealing pressure that ~~[[varies]]~~ non-linearly lags ~~[[with]]~~ the sensed processing pressure; ~~wherein the variable processing pressure varies between a vacuum and a supercritical pressure.~~

Claim 23 (currently amended): An apparatus for processing a semiconductor wafer, comprising:

- a. a processing chamber comprising a processing volume for processing the semiconductor wafer by generating a variable processing pressure; and
- b. a seal energizer configured to maintain the processing volume by maintaining a difference between a sealing force and a force generated within the processing volume within a preselected range, wherein the range is independent of pressures generated within the processing volume and the pressures generated within the processing volume vary between a vacuum and a supercritical pressure.

Claim 24 (currently amended): The apparatus of claim 23, further comprising a controller programmed ~~configured to follow an algorithm~~ to determine the sealing force, ~~the algorithm accounting for non-linear variations between the sealing force, the force generated within the processing volume, and the difference between the sealing force and the force generated within the processing volume.~~

Claim 25 (new): The apparatus of claim 1, wherein the pressure controller comprises a pressure regulator.

Claim 26 (new): The apparatus of claim 25, further comprising a pressure monitor coupled to the processing volume and to the pressure regulator.